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Climate trends derived from long-term ground-based GNSS-derived Zenith Total Delay (ZTD)

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We present findings from an ongoing investigation into the evaluation of long-term trends in ground-based GNSS-derived Zenith Total Delay (ZTD) for potential integration into climate models, either for assimilation or validation purposes. Our analysis focuses on ZTD time series obtained from six REPRO3 IGS Analysis Centers (ACs) – COD, ESA, GFZ, GRG, JPL, and TUG – spanning 20 years or more. Thirty stations from the IGS global network were selected for this study. The ZTD time series underwent a homogenization process, utilizing ERA-5 derived ZTDs as a reference, followed by daily value averaging to minimize potential discrepancies arising from diverse estimation strategies employed by individual ACs. Similar averaging procedures were applied to ERA-5 ZTDs and the IGS tropo-product if already reprocessed in REPRO3. Two combinations, employing weighted mean and a robust least median of squares, were generated from the six homogenized ACs, serving as quality control measures for each AC. Analysis of trends in each of the nine ZTD time series was conducted in both time and frequency domains, revealing geographical variations in results. For instance, at station ALBH in Canada, the inter-AC scatter was 0.47 mm/decade for trends, 0.11 mm for annual amplitudes, and 0.29 degrees for annual phases.